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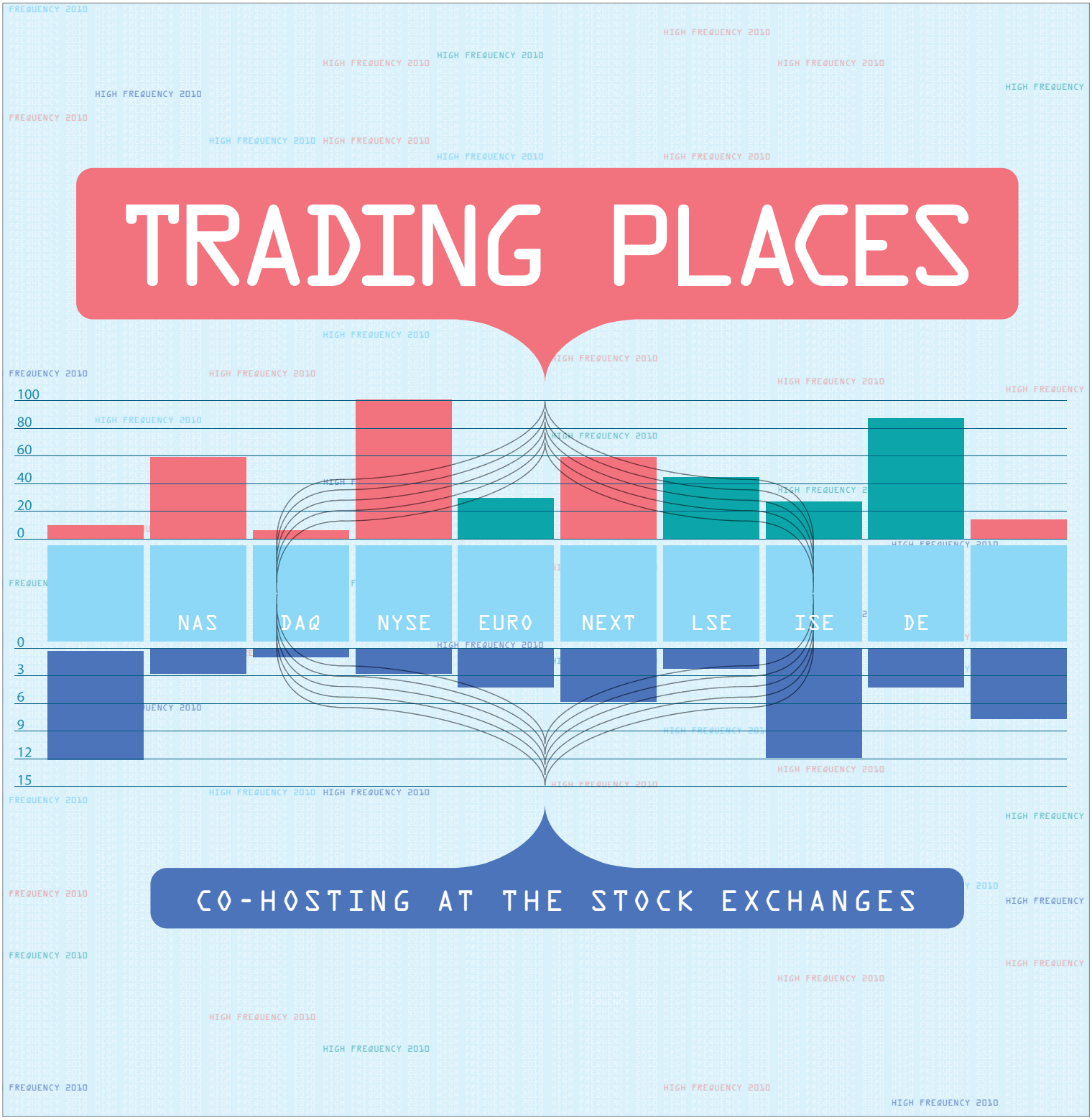
TRADING PLACES



CO-HOSTING AT THE STOCK EXCHANGES

IS THE SMART GRID AN INTELLIGENT MOVE?

Does the smart grid have a role to play in the future of data centers? By Yevgeniy Sverdlik

The system of power delivery in the US is in trouble – it is old and creaking. To prevent more gigantic financial losses similar to the ones the US economy has already experienced as a result of blackouts, the government is looking to change the way in which the grid is designed and operated.

The US Department of Energy (DoE) is investing in the research and development of the 'smart grid'. It defines two main stages in this theoretical development process: a smart grid and a smarter grid.

A smart grid is the vision of a more removed future, according to the DoE's 2008 paper on the subject, *The Smart Grid: An Introduction*: "The longer-term promise of a grid remarkable in its intelligence and impressive in its scope."

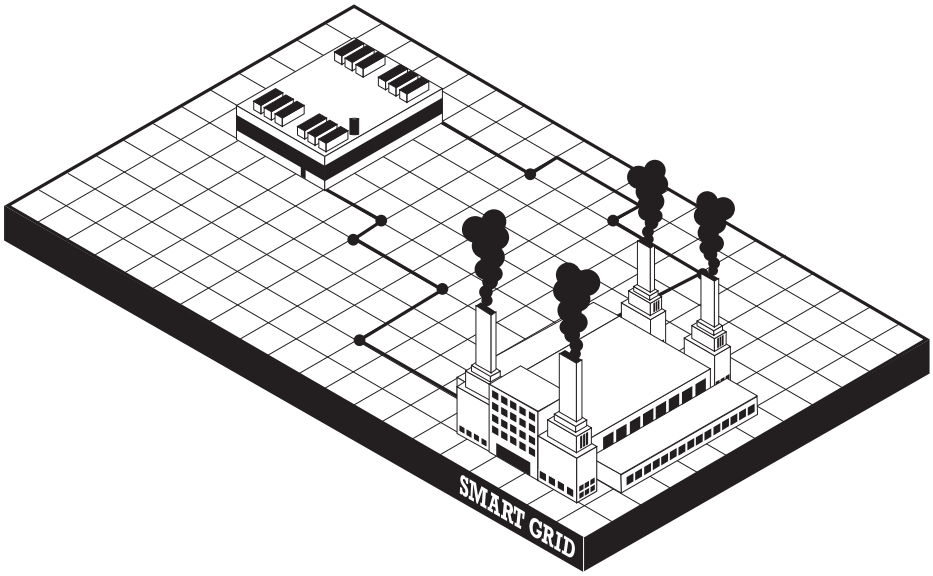
A smarter grid is one that can be built using technology that is available today, or that will become available in the near future.

Today's grid, according to the DoE, is characterised by uninformed consumers, dominance of central generation, limited wholesale markets, slow response to power quality issues, poor integration of operational data with asset management, and vulnerability to "malicious acts of terror and natural disasters".

The DoE's vision of the smart grid is that of a system whose consumers are involved and active – one that leverages demand response and distributed energy sources. A smart grid has many distributed energy sources, with focus on renewable energy. The future system is one that is resilient to attacks and natural disasters, and where power quality is a priority.

According to the DoE paper, growth in peak demand for electricity in the US has exceeded growth in transmission by 25% annually since 1982. Lack of sufficient investment into transmission and distribution infrastructure in the country has compromised the grid's efficiency and reliability.

The US economy has already paid dearly for the lacklustre state of the nation's electrical infrastructure. According to the DoE, a rolling blackout across Silicon Valley resulted in losses that totalled $75m. A one-hour outage at the Chicago Board of Trade in 2000 caused a delay in trades that were cumulatively worth about $20 trillion.



The 2003 blackout in the northeast (the largest in US history) caused about $6bn in economic losses to the region.

Theoretically, a smart grid is intelligent enough to sense and predict overloads and reroute power to avoid such outages or minimise their impact.

SMART BUILDINGS

An essential component of a smart grid is a smart consumer: a smart building. Data centers are some of the most intelligent buildings built. To GE's Marcel Van Helten, the strong relationship between the smart grid and the data center is a no-brainer.

"It is an interesting combination that absolutely makes sense," says Van Helten, infrastructure market director for GE Intelligent Platforms.

Van Helten sees three ways in which data centers relate to the smart grid: as consumers, as contributors and as enablers, although the first two, in a way, fold into the third.

"A data center is a load on the smart grid," says Van Helten. "What a smart grid wants to do is be more flexible for producers and consumers to better balance the electricity supply chain."

PEAK DEMAND

When a smart grid is at peak demand and needs to shed load, it can send a signal to some of its largest consumers to come off the grid fully or partially to reduce their consumption. A typical data center is already designed to be able to run independently of the utility feed for a prolonged period of time, and there is usually a largely automated process in place to make the transition quickly.

In Van Helten's opinion, convincing data center operators to work with their electricity providers in such a way would take incentivising them with lower rates. "For the data center, the energy is a huge cost factor. I would imagine that, in the spirit of making more money, they would actually make that decision."

Participation in a smart grid would also make a good component for a company's sustainability programme – something more and more organisations are concerned with.

"Data center operators are interested in being sustainable," Van Helten says. "They know they're a major energy consumer and they're looking at ways to reduce that."

Besides easing demand on the grid, data

centers can contribute electricity to it. One of the ways would be to contribute electricity produced during generator tests that are run periodically – something Mark Bramfitt, the former data center energy efficiency czar at PG&E (a California utility) has proposed at many industry events.

Van Helten's third theoretical connection point between the development of a smart grid and the data center sector is the main function of the data center: the transport, processing and storage of digital data.

With more and more chip-bearing devices coming online, collecting information about building energy use and sending it to the grid operator, that operator has an enormous amount of data to process and store. Data will be moving in all directions among smart meters, energy sources and the grid itself.

Van Helten says it is likely that utilities, instead of investing into building out and managing their own data centers, could start outsourcing that task to professional data center operators. "If you want to build that infrastructure for yourself, that's pretty expensive."

Along with the need to process, store and transport all the data the grid collects is a need to secure that data – also something data center operators specialise in. "A lot of the data centers are pretty secure," Van Helten says. "That's a Fort Knox for information."

DELIVERING ON PROMISES

Ronald Bowman, executive vice president at Tishman Technologies, says a bit of skepticism is needed in the current discussion of smart grids – an expression he says had been "tortured" by politicians and the media to the point of having little meaning.

Bowman says a lot of "intellectual dishonesty" took place in the market about the costs and benefits of smart grids on the part of vendors of products that enable it. "You need to level the expectation of what the grid can actually do for you," Bowman says.

Implementing a smart grid is "remarkably expensive" and a lot of what it does has already been done manually through the use of common communication methods.

A smart grid would, in effect, enable grid management processes that already take place to be highly automated.

Rather than becoming integrated with smart grids, Bowman says data centers in the US would be better off moving toward increased independence of the electrical grid by increasing their energy efficiency and developing their own generation capacity, or building facilities next to generation plants.

He says that because today's electrical grid in the US is unreliable, "you'd want to go with co-generation, or bolt on your data center closer to a power-creation source".

Bringing a facility closer to the generation source reduces the risk of power disruption caused by grid failure.

Some organisations have made great headway with co-generation. Bowman uses the well-publicised Syracuse University data center project as an example. Along with IBM, the university is building a data center that will be powered completely by an on-site co-generation system, which will be based on a micro turbine that is fuelled by natural gas.

"On-site co-generation absolutely makes sense and should be done more," Bowman says. "Self-help is a far greater silver bullet than putting a meter on every device in the country and calling it smart."

MORE CONCRETE DATA

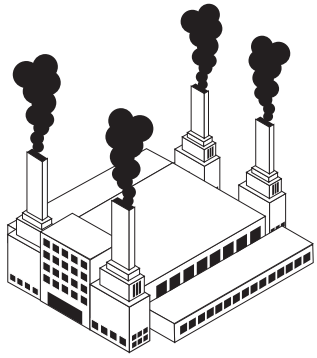
A key function of a smart grid is enabling effective demand response. This is when electricity consumers adjust their consumption based on the load on the grid. If the grid is at peak demand, consumers reduce their consumption to ease the strain.

One of the most recent research projects funded by the DoE is a study by Lawrence Berkeley National Laboratories, in collaboration with the California Energy Commission, on the feasibility of implementing demand response in data centers. This was a scoping study – a study that identifies opportunities and makes recommendations for further exploration.

PG&E contributed funding to the project. As *DCD Focus* went to press, the final report on the study was completed but had not yet been published.

Lawrence Berkeley National Laboratory researcher Girish Ghatikar, one of the study's authors, provided *DatacenterDynamics* with insight into some of the project's conclusions.

The researchers concluded that there was significant potential for demand response in data centers. The most likely candidates



for early adoption, however, would be data centers that support non-mission-critical applications, such as computer rooms that serve research labs.

One opportunity for demand response and load reduction was using virtualisation to reduce energy consumption by IT equipment, according to the researchers.

There are also opportunities for demand response on the facilities side: for example, HVAC and lighting systems.

Virtualisation is a promising tool in implementing demand response because it can be used to dynamically control utilisation of server processors and thus the servers' overall electricity consumption.

One of the study's key findings is that a quicker demand response and better planning is most likely to be achieved if both IT and facility infrastructure work together to shed load. If IT load is reduced, so is demand for cooling. Along with a reduced load, losses associated with power distribution are reduced as well.

Researchers say that more in-depth studies are needed in order to quantify the benefits that participation in utility demand response programmes would bring data center operators. Quantification of the effects that such participation would have on data center performance, quality of service and the life span of equipment are also needed.

AT A CROSSROADS

With the idea of the smart grid still remaining little more than just an idea, and with all the uncertainty surrounding it, works in progress and convoluted messages, the industry is facing yet another decision that could potentially have radical implications for its future: should data centers participate in the development of the smart grid, being such crucial enablers of the concept? Or, is it time they considered alternatives – such as Bowman's advice – and started thinking about getting off the grid altogether instead? ■